# Climate Change Planning in Alaska's National Parks

Scenarios Network
FOR ALASKA & ARCTIC PLANNING

## CENTAL ALASKA PARKS

# Webinar #1: Introduction to Scenarios Planning

**April 4, 2012**

# *Part I:* General Background

OVERALL PROJECT BACKGROUND

FOCAL PARKS

PARTICIPANTS

WHAT IS SNAP?

OVERVIEW OF WEBINARS

PRE-WORKSHOP READINGS

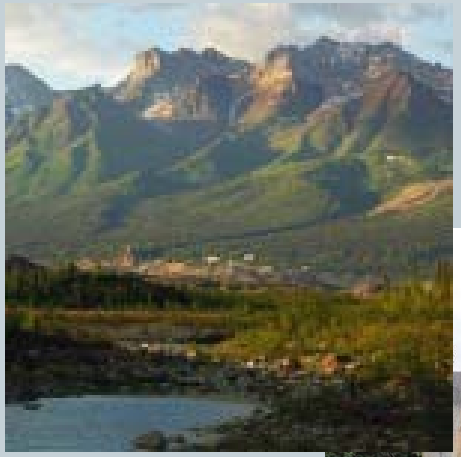
# Overall Project Summary

- Changing climatic conditions are rapidly impacting environmental, social, and economic conditions in and around National Park System areas in Alaska.

- Alaska park managers need to better understand possible climate change trends in order to better manage Arctic, subarctic, and coastal ecosystems and human uses.

- NPS and the University of Alaska's Scenarios Network for Alaska Planning (UAF-SNAP) are collaborating on a three-year project that will help Alaska NPS managers, cooperating personnel, and key stakeholders to develop plausible climate change scenarios for all NPS areas in Alaska.

# Park Photos -- Focal Parks



**Wrangell St. Elias National Park and Preserve**
NPS photo


**Denali National Park and Preserve**
*Jay Cable*

**Yukon-Charley Rivers National Preserve**
NPS photo

# SNAP: Scenarios Network for Alaska & Arctic Planning

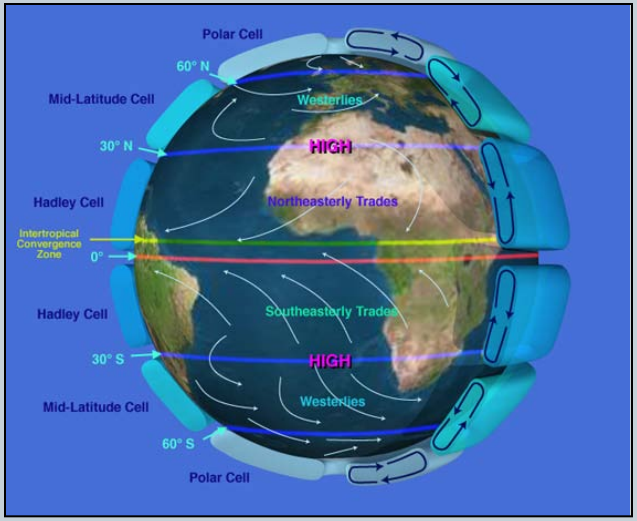
- What is most important to Alaskans and other Arctic partners?
  - What changes are most likely?
  - What changes will have the greatest impact?
  - How can we adapt to those changes?
  - What are we best able to predict?
- Scenarios are linked to SNAP models
  - Climate models
  - Models of how people use land and resources
  - Other models linked to climate and human behavior

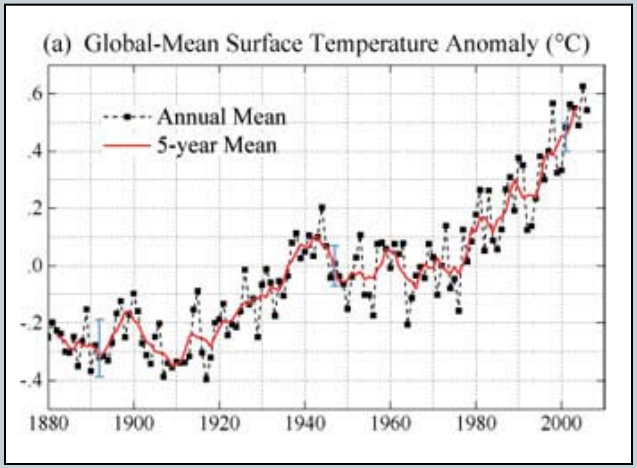

***www.snap.uaf.edu***

# Understanding the Science of Climate Change

*[See also ppt entitled "Understanding the Science of Climate Change: Climate drivers and climate effects"]*

- There is now unequivocal scientific evidence that our planet is warming
- How this warming will affect climate systems around the globe is an enormously complex question
- Uncertainty and variability are inevitable
- Climate change presents significant risks to natural and cultural resources
- Understanding how to address uncertainty is an important part of climate change planning



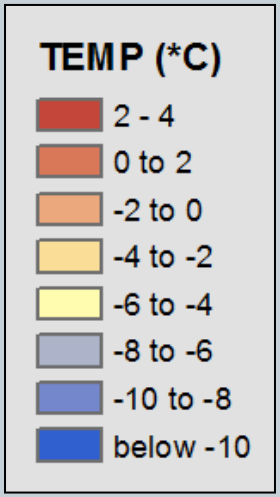



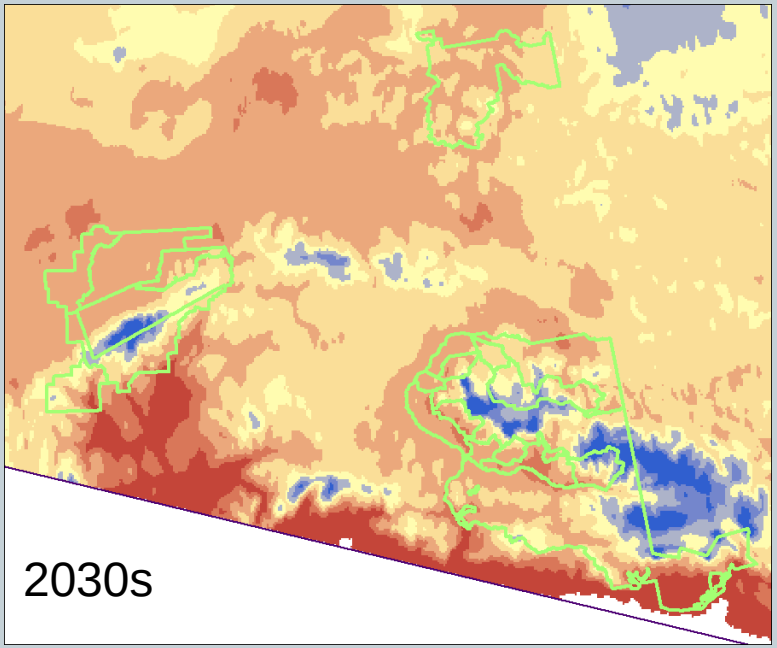

http://geology.com/news/labels/Global-Warming.html

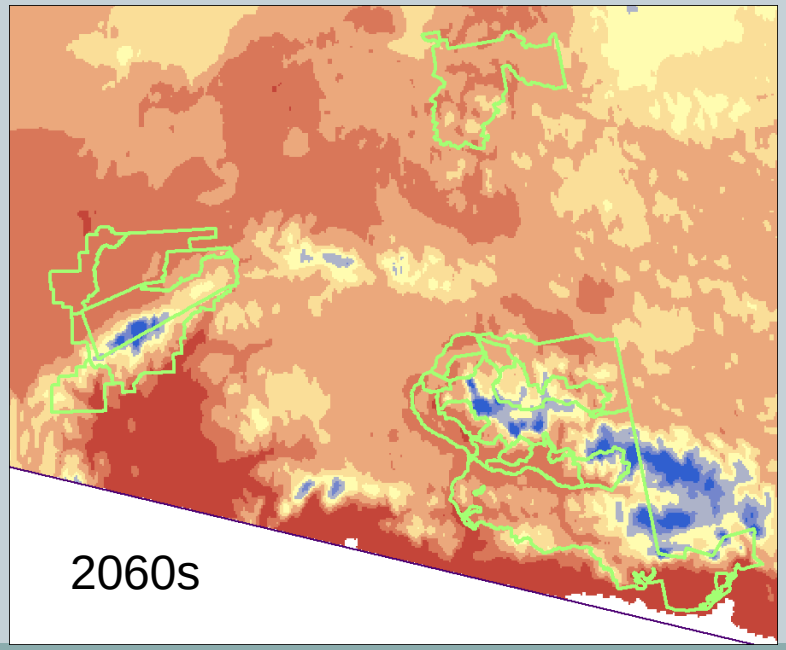
# Central Alaska Annual Temperature Projections

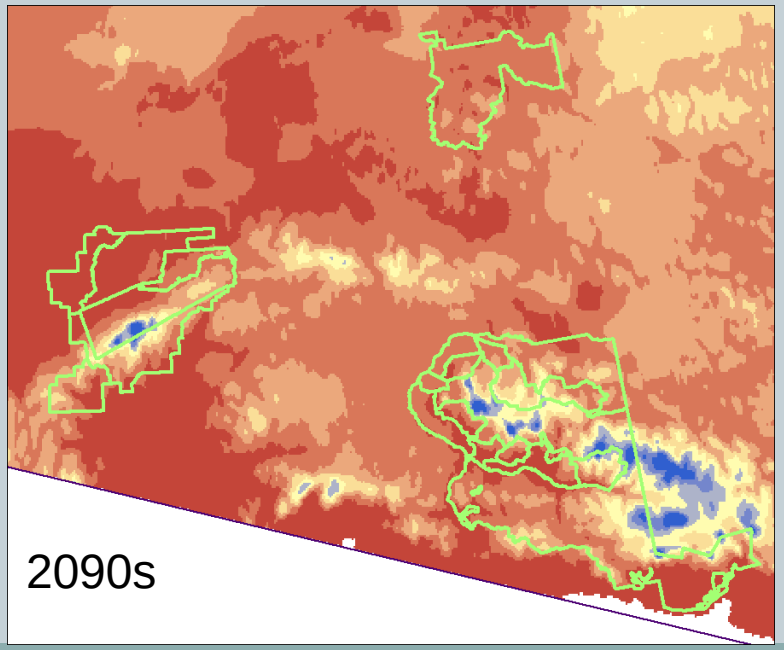
**5-model average**
**A1B scenario**

SNAP



# Central Alaska Winter Temperature Projections

**5-model average**
**A1B scenario**

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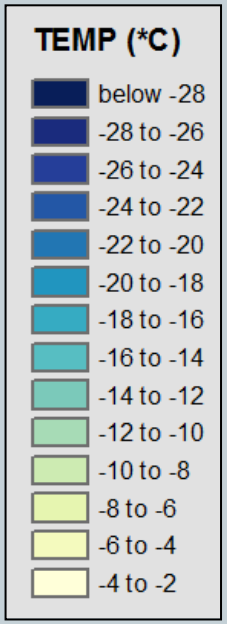
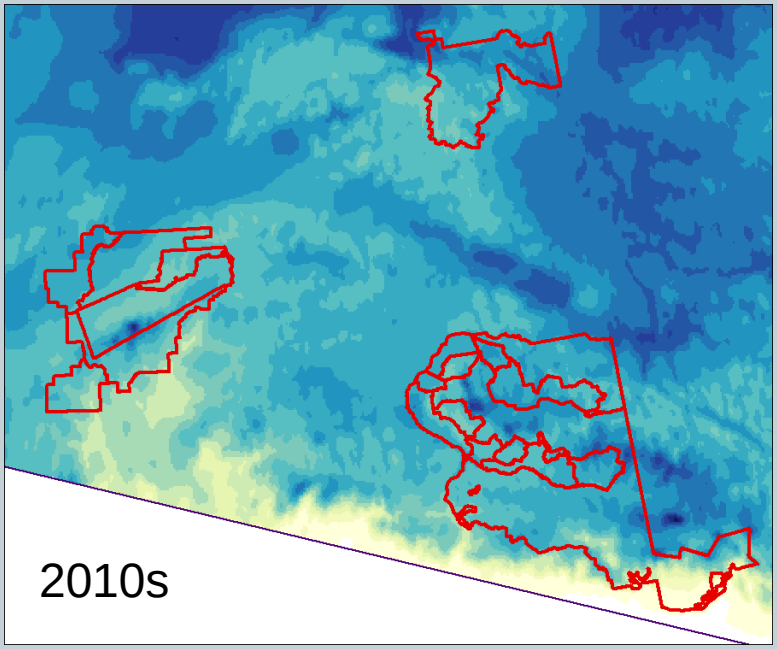
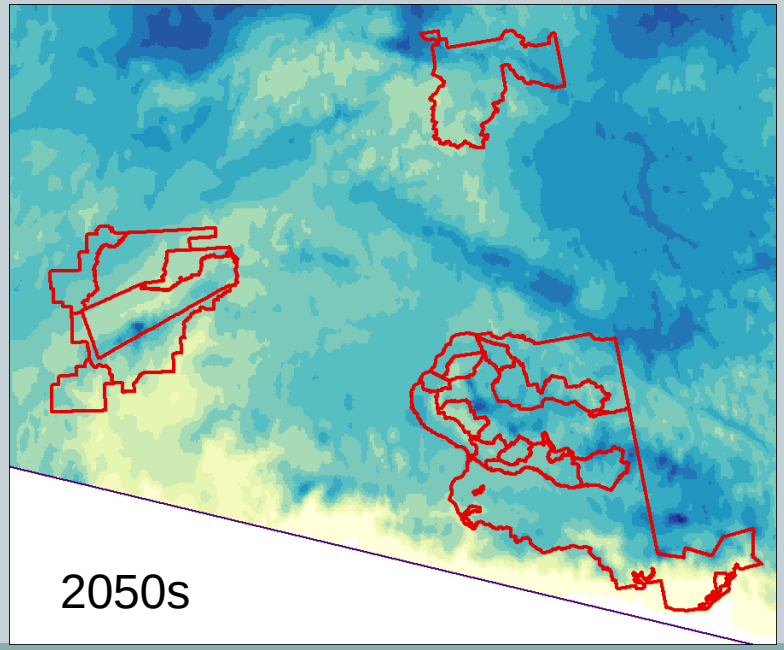
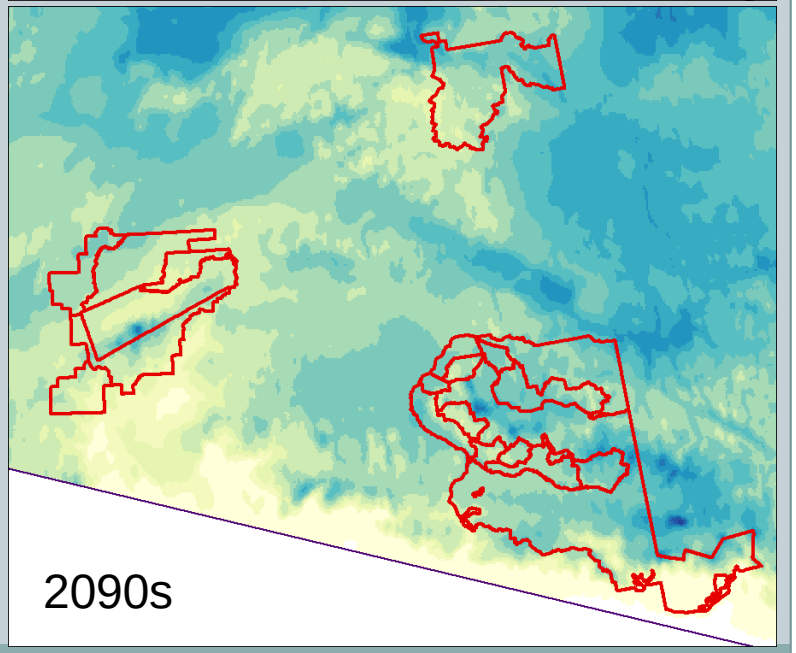


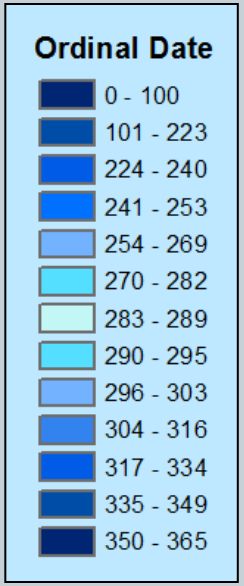



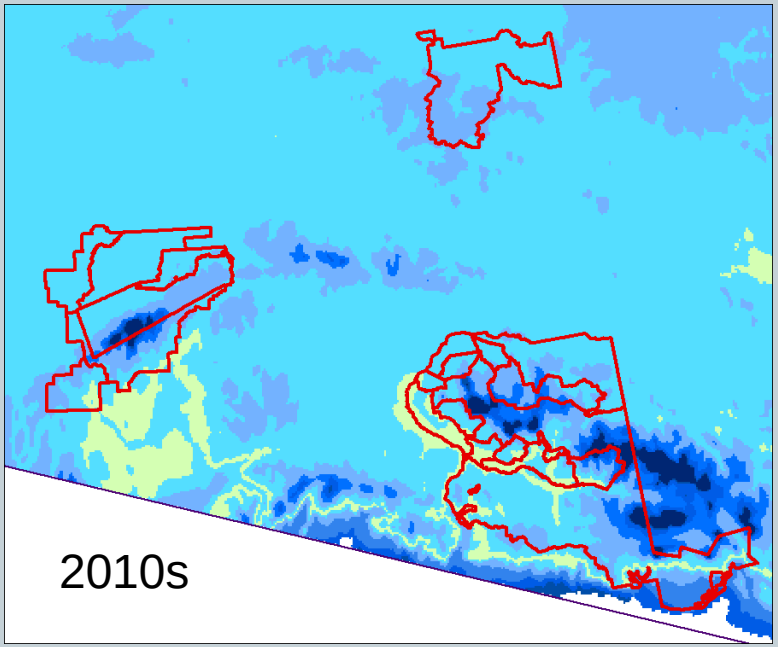



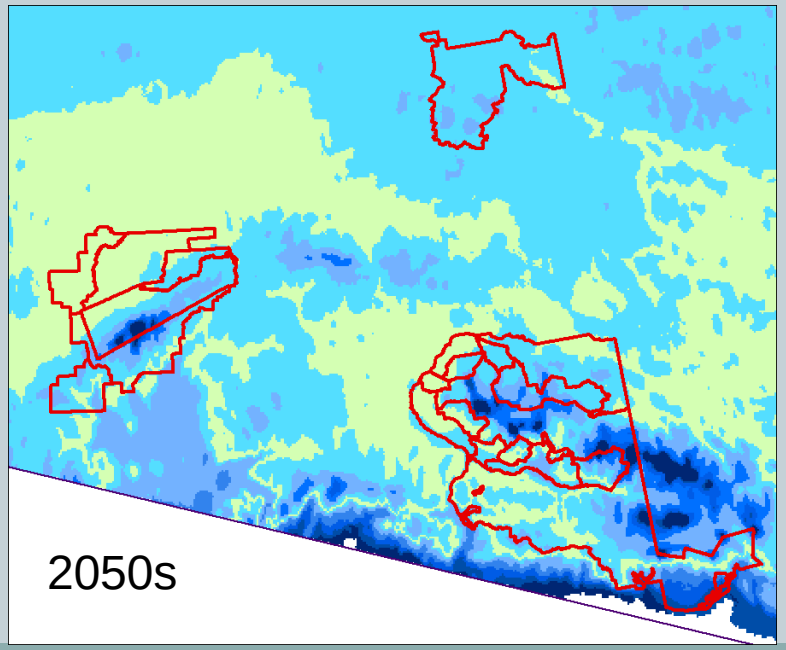
# Central Alaska Date of Freeze Projections

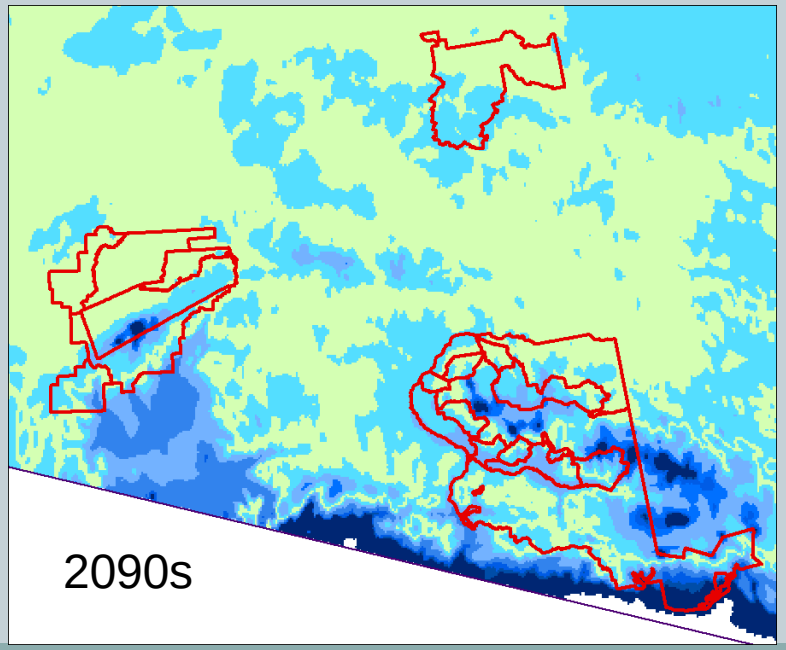
**5-model average**
**A1B scenario**

SNAP



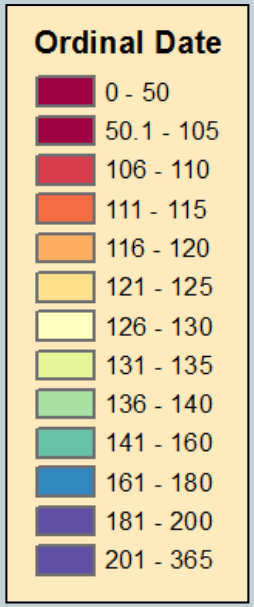



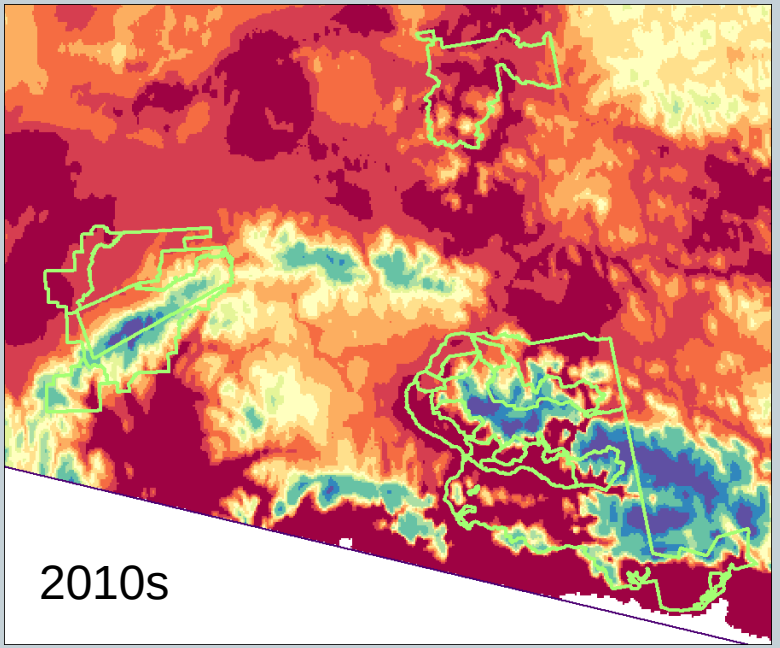



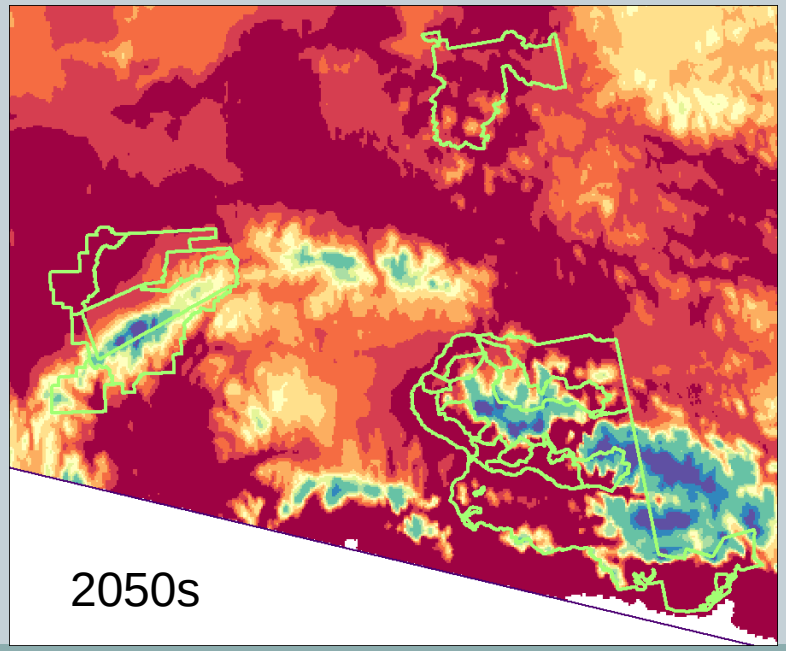
# Central Alaska Date of Thaw Projections

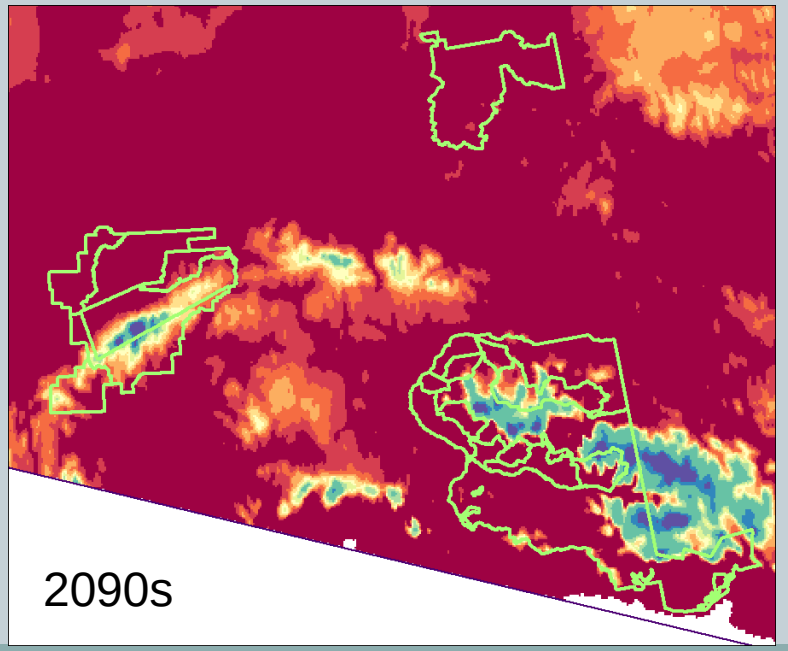
**5-model average**
**A1B scenario**

SNAP



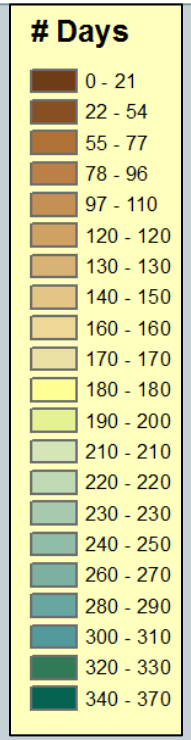



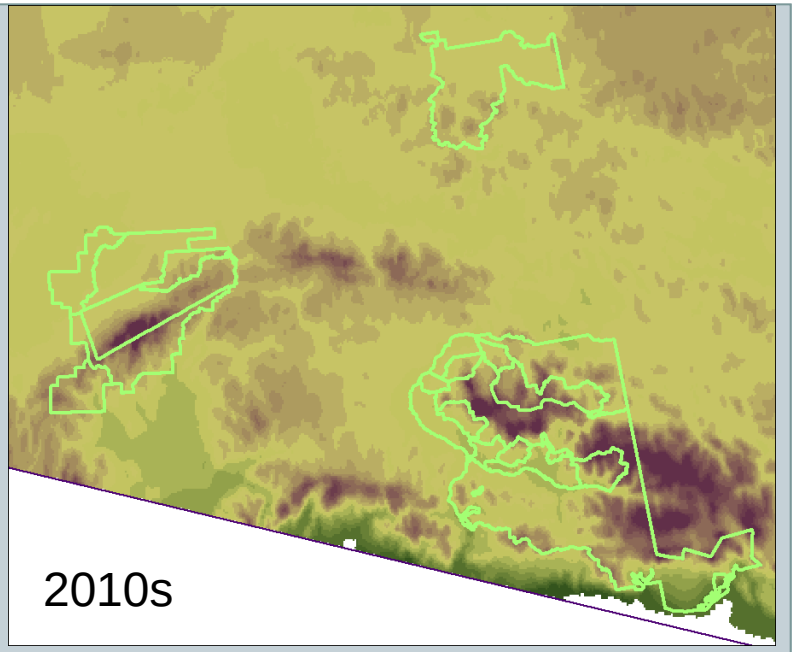



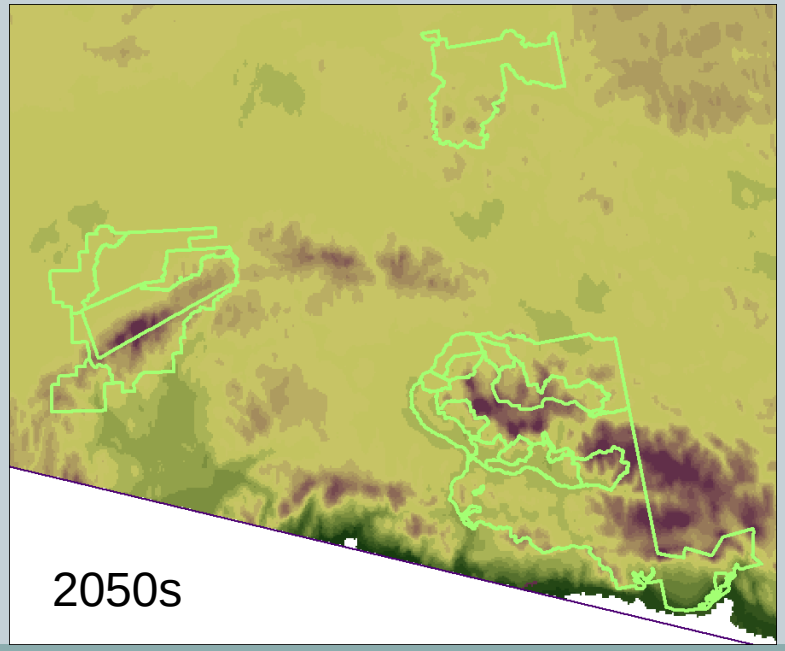
# Central Alaska Length of Growing Season Projections

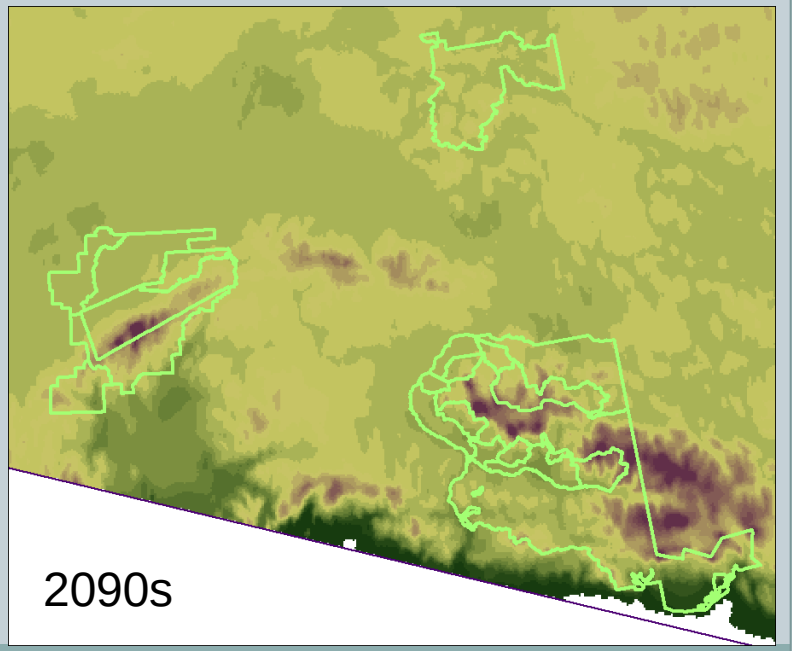
**5-model average**
**A1B scenario**

SNAP



# Pre-workshop webinar#1

*April 4, 2012*

- Introduce the basic concepts of scenarios planning, as outlined by GBN;
- Outline data and resources available through SNAP and other sources;
- Underscore the general importance of planning for climate change;
- Review case studies, including all decision-making processes and generation of intermediate steps and results.
- "Homework" assignments

# Pre-workshop webinar#2

*April 11, 2012*

- Overview of climate-linked drivers of change for the Southwest Alaska park network
- Discussion of a drivers table generated by John Walsh and SNAP
- Case studies and examples
- Climate effects – your input from survey
- Group discussion of climate effects table
  - Individual input
  - Drivers grouped by category
  - Differences in opinion
  - Variations between parks

# Readings (pt. 1)

- *The Art of the Long View, emphasis on first 4 pages (pp. 3-6); User's Guide (pp. 227-239); and Appendix (pp.241-248).* These can all be read for free on Amazon at http://www.amazon.com/Art-Long-View-Planning-Uncertain/dp/0385267320

  in the page previews ("Click to Look Inside")
- SNAP one-page fact sheet *(Tools for Planners)* and link to website for optional browsing.
- Detailed notes from the February meeting.
- SNAP climate change summary reports for each park.

**All project documents will be made available at a public download site here:**
**http://snap.uaf.edu/webshared/Nancy%20Fresco/NPS/2012%20Central%20Alaska/**

# Readings (pt. 2)

- *Boreal and Arctic Talking Points*, entire document, online at http://snap.uaf.edu/webshared/Nancy%20Fresco/NPS/Webinar%201%20ARCN/
- *Beyond Naturalness* by David N. Cole and Laurie Yung entire book, but with a focus on pp. 31-33. This section is available for preview on Google Books. http://books.google.com/books?id=gfErgkCy0HkC&printsec=frontcover&cd=1&source=gbs_ViewAPI#v=onepage&q&f=false
- *Northwest Alaska Climate Drivers table*

# *Part II:*
# Data and Information Sources

SNAP METHODS

SNAP DATA

SNAP MAPS

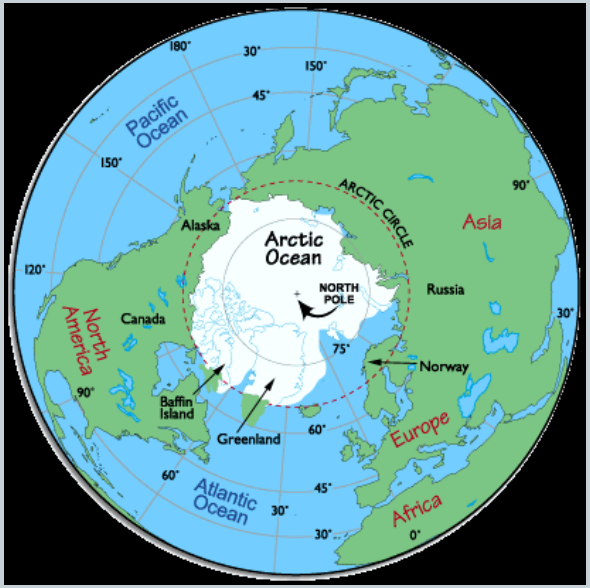
NPS TALKING POINTS PAPERS

CLIMATE DRIVERS

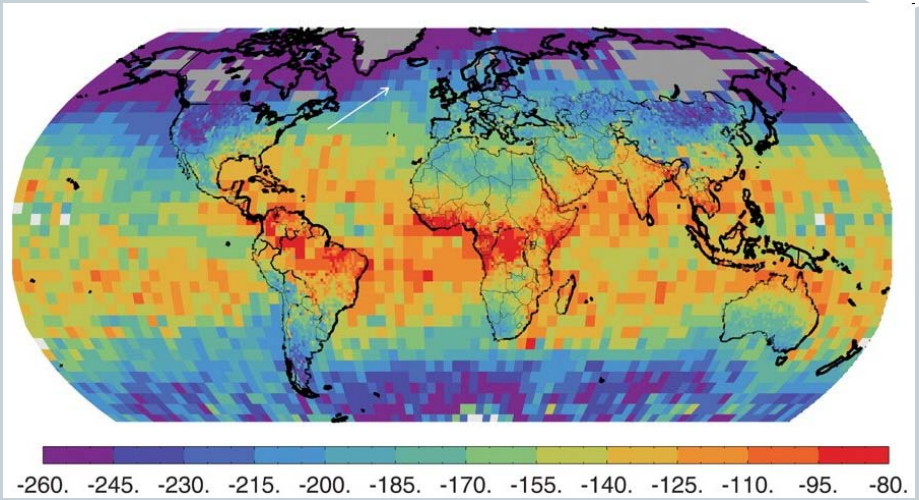
CLIMATE EFFECTS

# SNAP Methods: Projections based on IPCC models

- Calculated concurrence of 15 models with data for 1958-2000 for surface air temperature, air pressure at sea level, and precipitation.
- Used root-mean-square error (RMSE) evaluation to select the 5 models that performed best for Alaska, 60-90°N, and 20-90°N latitude.
- A1B, B1 and A2 emissions scenarios.
- Downscaled coarse GCM data to 2km using PRISM.



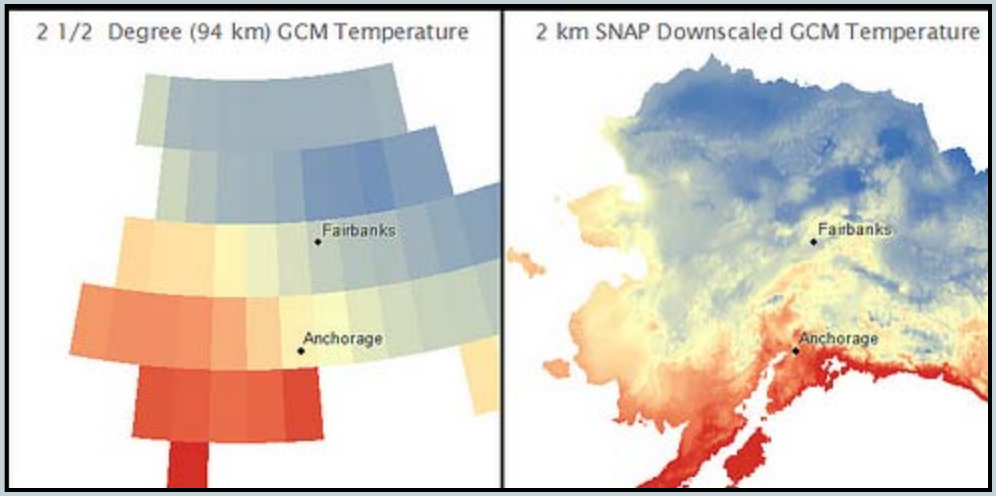
# Benefits of downscaling




GCM output (ECHAM5)
2.5 x 2.5 degrees

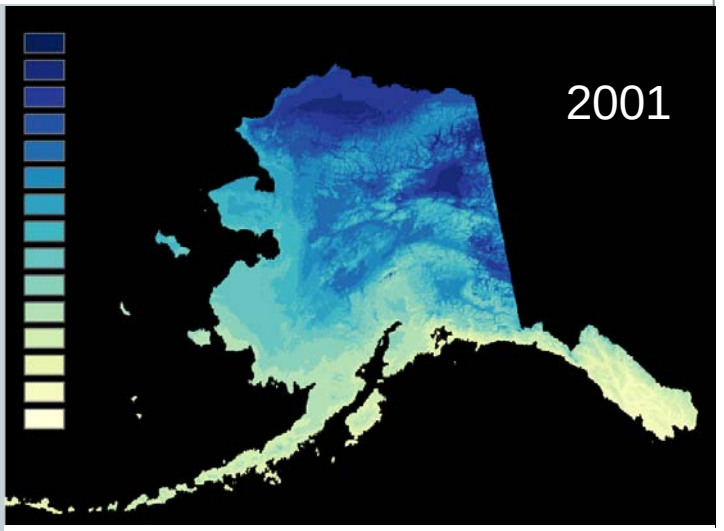
*Frankenberg et al., Science, Sept. 11, 2009*

SNAP outputs after downscaling to CRU and PRISM data
2 x 2 km

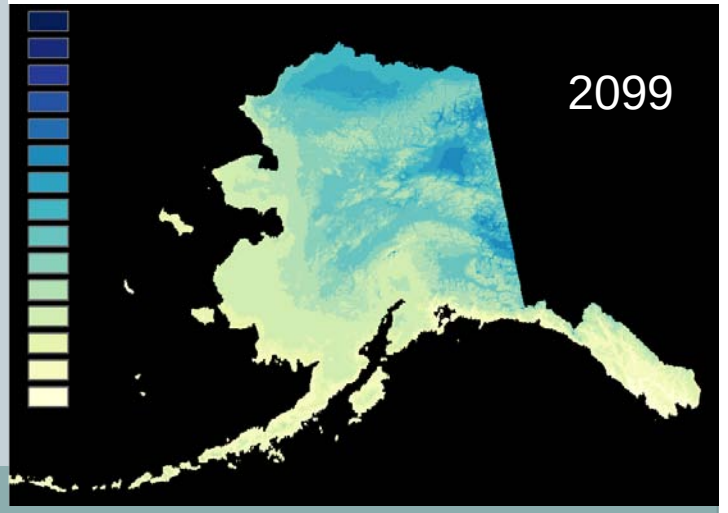


# SNAP data: climate projections

- Temperature
- Precipitation (rain and snow)
- Every month of every year from 1900-2100 (historical + projected)
- 5 models, 3 emission scenarios
- Available as maps, graphs, charts, raw data
- On line, downloadable, in Google Earth, or in printable formats



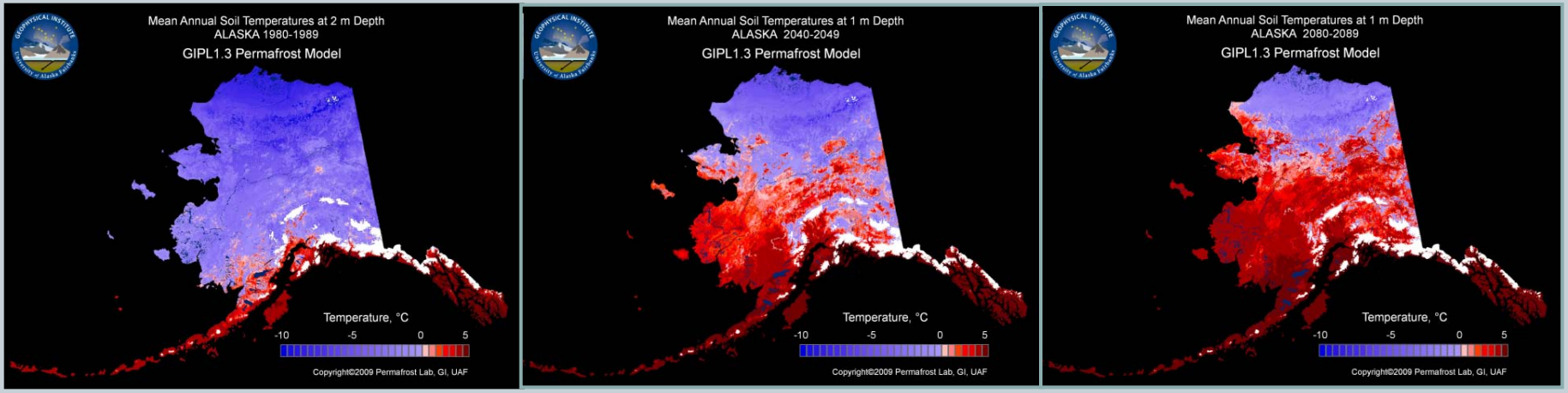

Projected January temperatures



# SNAP data: complex linked models

- Season length
- Shifting plants and animals (biomes and ecosystems)
- Soil temperature and permafrost
- Water availability
- Forest fire

*Soil temperature at 1-meter depth: 1980s, 2040s, and 2080s*



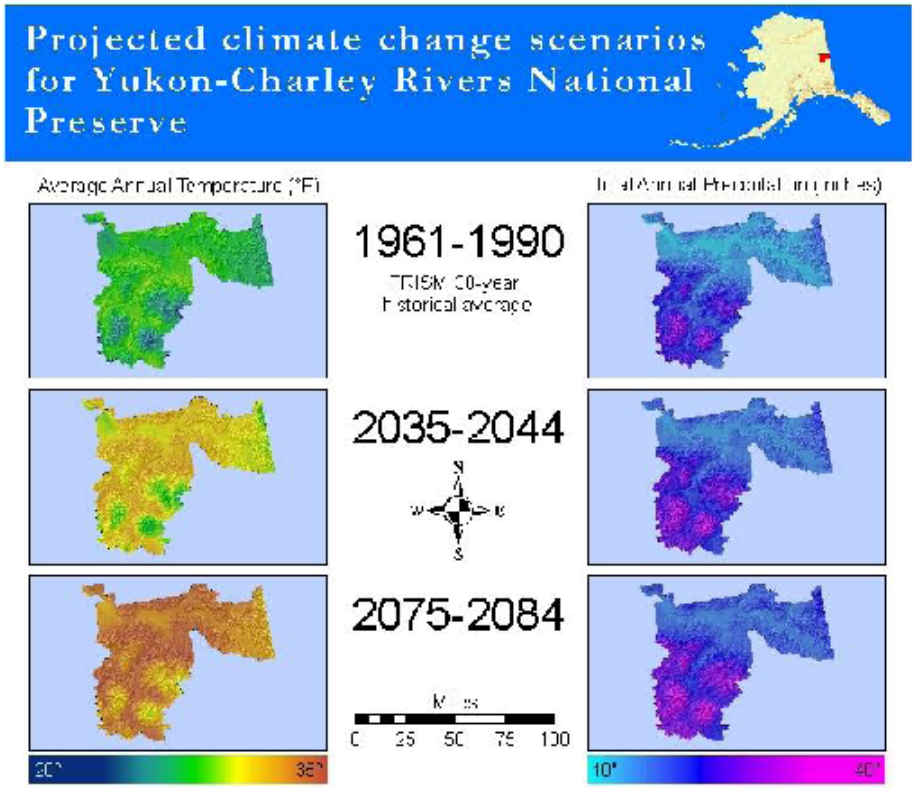

*(Geophysical Institute Permafrost Lab, UAF)*

# NPS Talking Points Papers

- Available for *Alaska Maritime and Transitional* and *Alaska Boreal and Arctic*
- Provide park and refuge area managers and staff with accessible, up-to-date information about climate change impacts to the resources they protect
- Talking Points have three major sections:
  - a regional section that provides information on changes, organized around seven types of impacts
  - a section outlining No Regrets Actions that can be taken now to mitigate and adapt to climate changes
  - and a general section on Global Climate Change arranged around four topics

Access these and other documents at http://www.snap.uaf.edu/webshared/Nancy%20Fresco/NPS/

**SNAP climate change summary reports are available for all parks in the state, and can be downloaded from the SNAP webiste (www.snap.uaf.edu)**




## Magnitude of climatic change

| Projected Temperature (TEMP) Change (°F) | | | | Projected Precipitation (PRCP) Change (in.) | | | | |
|---|---|---|---|---|---|---|---|---|
| Season | Time | Avg. TEMP | Δ TEMP* | Season | Time | Total PRCP | Δ PRCP* | % Δ PRCP* |
| Annual | Hist. | 24.7 ± 0.4 | NA | Annual | Hist. | 17.0 ± 2.7 | NA | NA |
| | 2040 | 29.4 ± 0.4 | 4.6 | | 2040 | 19.9 ± 2.7 | 2.9 | 17% |
| | 2080 | 33.2 ± 0.4 | 8.4 | | 2080 | 21.6 ± 2.7 | 4.6 | 27% |
| Summer | Hist. | 49.2 ± 1.2 | NA | Summer | Hist. | 10.9 ± 2.1 | NA | NA |
| | 2040 | 51.8 ± 1.2 | 2.5 | | 2040 | 12.4 ± 2.1 | 1.5 | 14% |
| | 2080 | 54.9 ± 1.2 | 5.6 | | 2080 | 13.1 ± 2.1 | 2.2 | 20% |
| Winter | Hist. | 7.2 ± 0.8 | NA | Winter | Hist. | 5.1 ± 0.5 | NA | NA |
| | 2040 | 13.4 ± 0.8 | 6.2 | | 2040 | 7.5 ± 0.5 | 2.4 | 46% |
| | 2080 | 17.6 ± 0.8 | 10.4 | | 2080 | 8.6 ± 0.5 | 3.5 | 68% |

* Δ PRCP/TEMP: change in decade precipitation/temperature average from historical value


*For more information:*
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*Dr. Wendy Loya, Ecologist, The Wilderness Society, Alaska Region, 907-272-9453; wendy_loya@tws.org*

# Part III:
# Global Business Network (GBN) Scenarios Planning Process

**AUGUST 2010 TRAINING WORKSHOP**

**FORECASTS vs. SCENARIOS**

**STEPS IN SCENARIOS PLANNING:**

- **Orient**
- **Explore**
- **Synthesize**
- **Act**
- **Monitor**

# August 2010 training workshop

## Climate change scenarios training

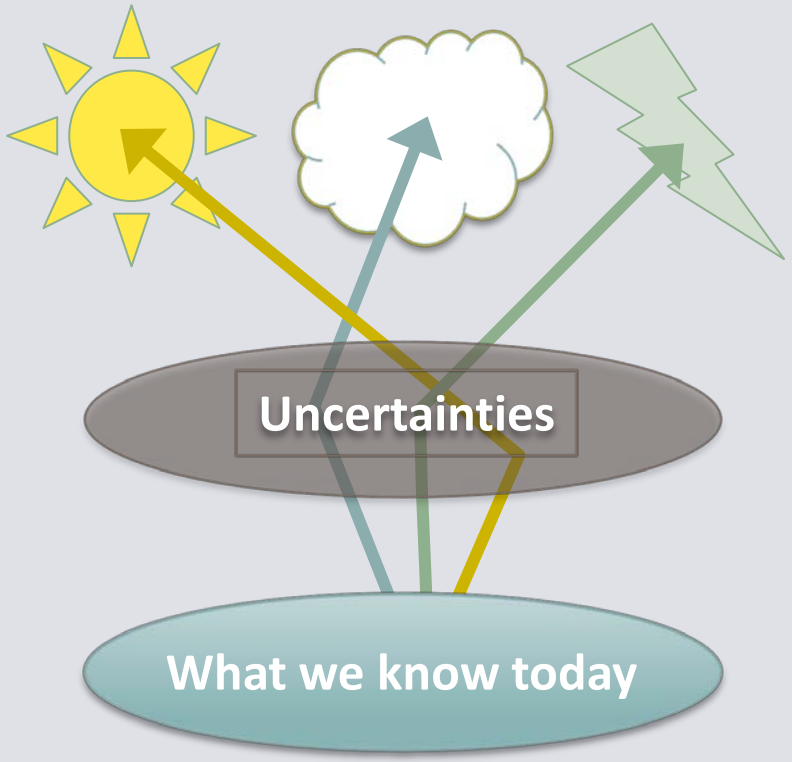
- Facilitated and led by Jonathan Star of Global Business Network (GBN)
- Participants included trainers, NPS staff from diverse regions and departments, SNAP researchers, and representatives of cooperating agencies.
- Participants learned how to develop scenarios based on nested framework of critical uncertainties
- Participants fleshed out beginnings of climate change scenarios for two pilot park networks

# Forecasts vs. Scenarios

- *Scenarios overcome the tendency to predict, allowing us to see multiple possibilities for the future*

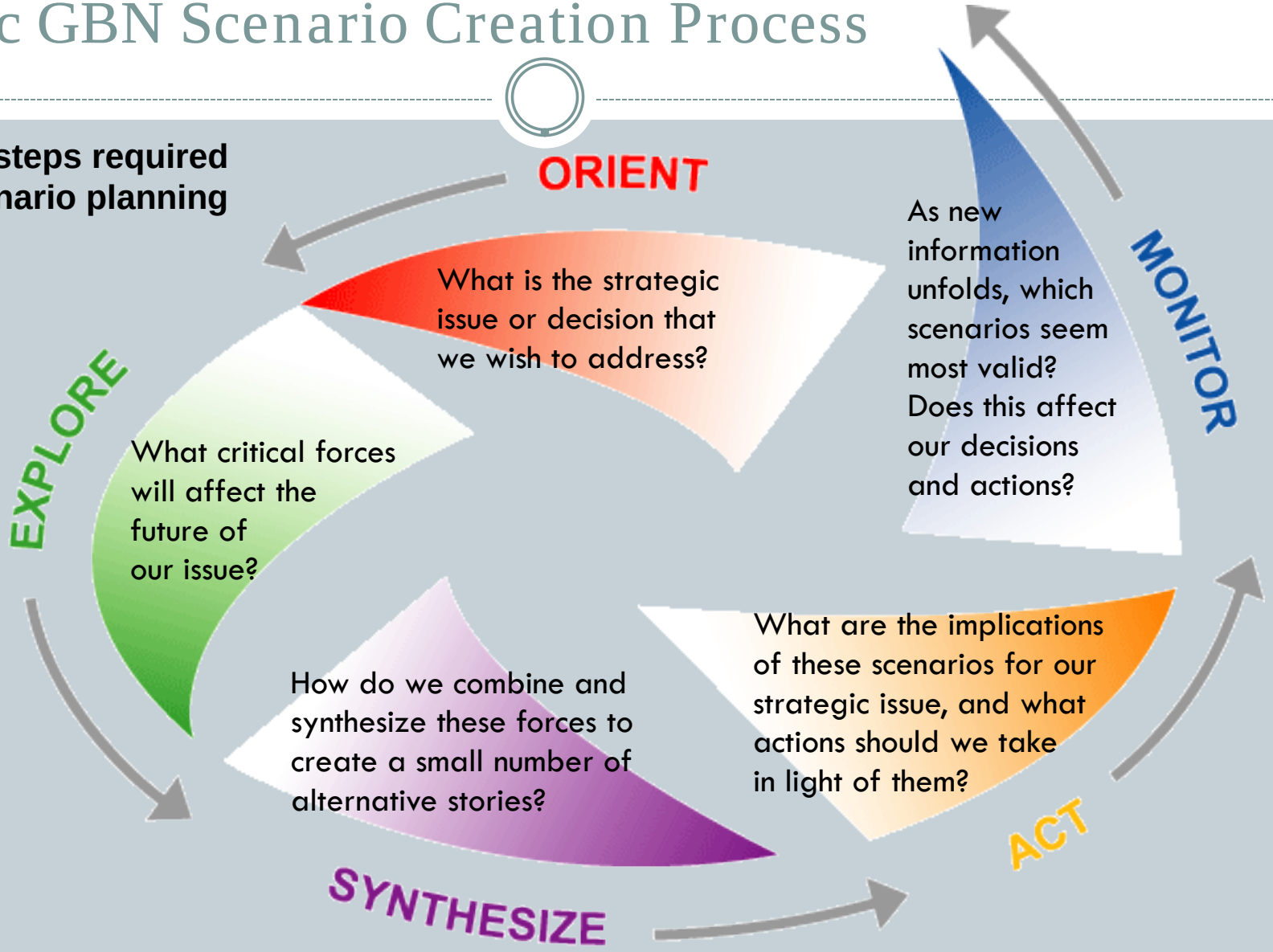
- Forecast Planning
- One Future


- Scenario Planning
- Multiple Futures



# Explaining Scenarios:
# A Basic GBN Scenario Creation Process

**The 5 key steps required in any scenario planning process**



# Step one: Orient

What is the strategic issue or decision that we wish to address?

**How can NPS managers best preserve the natural and cultural resources and values within their jurisdiction in the face of climate change?**

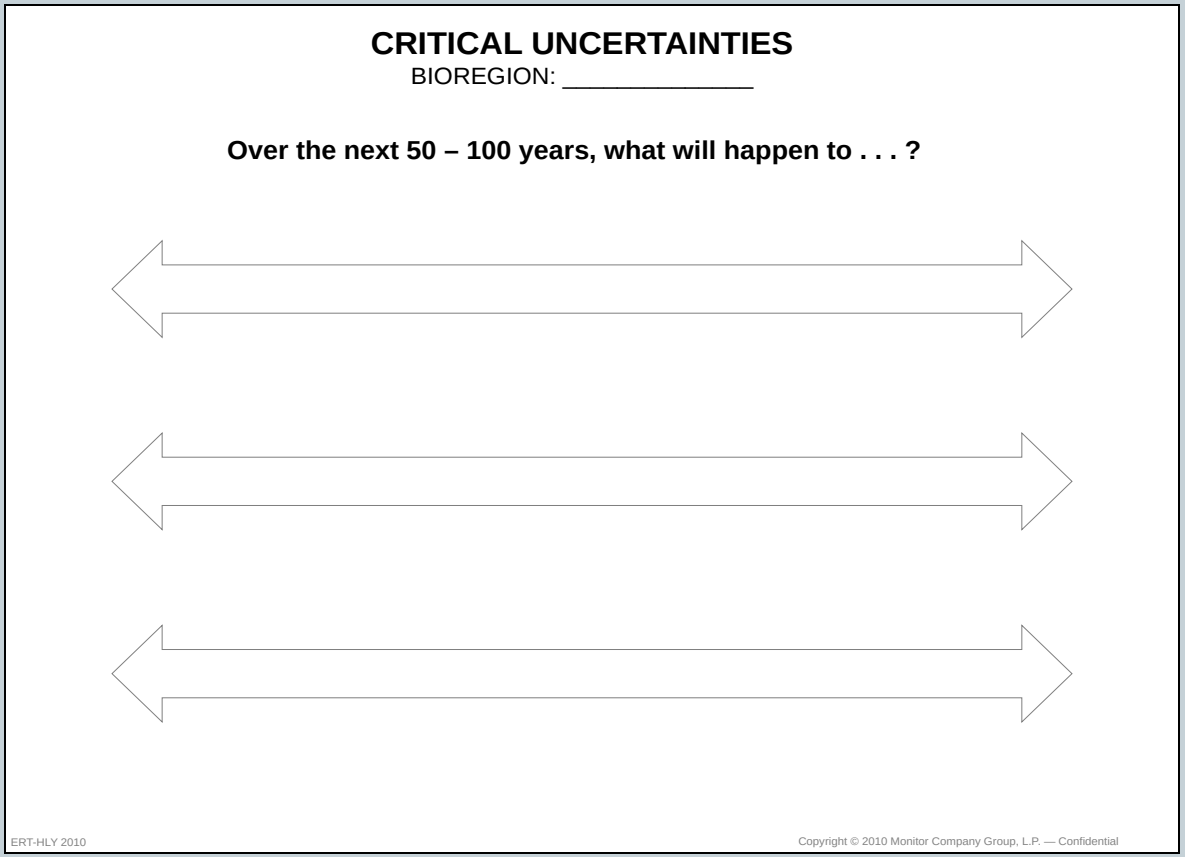
*Denali National Park*
*photo credits: Jay Cable,*

To answer this challenge, we need to explore a broader question:

**How will climate change effects impact the landscapes within which management units are placed over the next 50 to 100 years?**

# Step Two: Explore

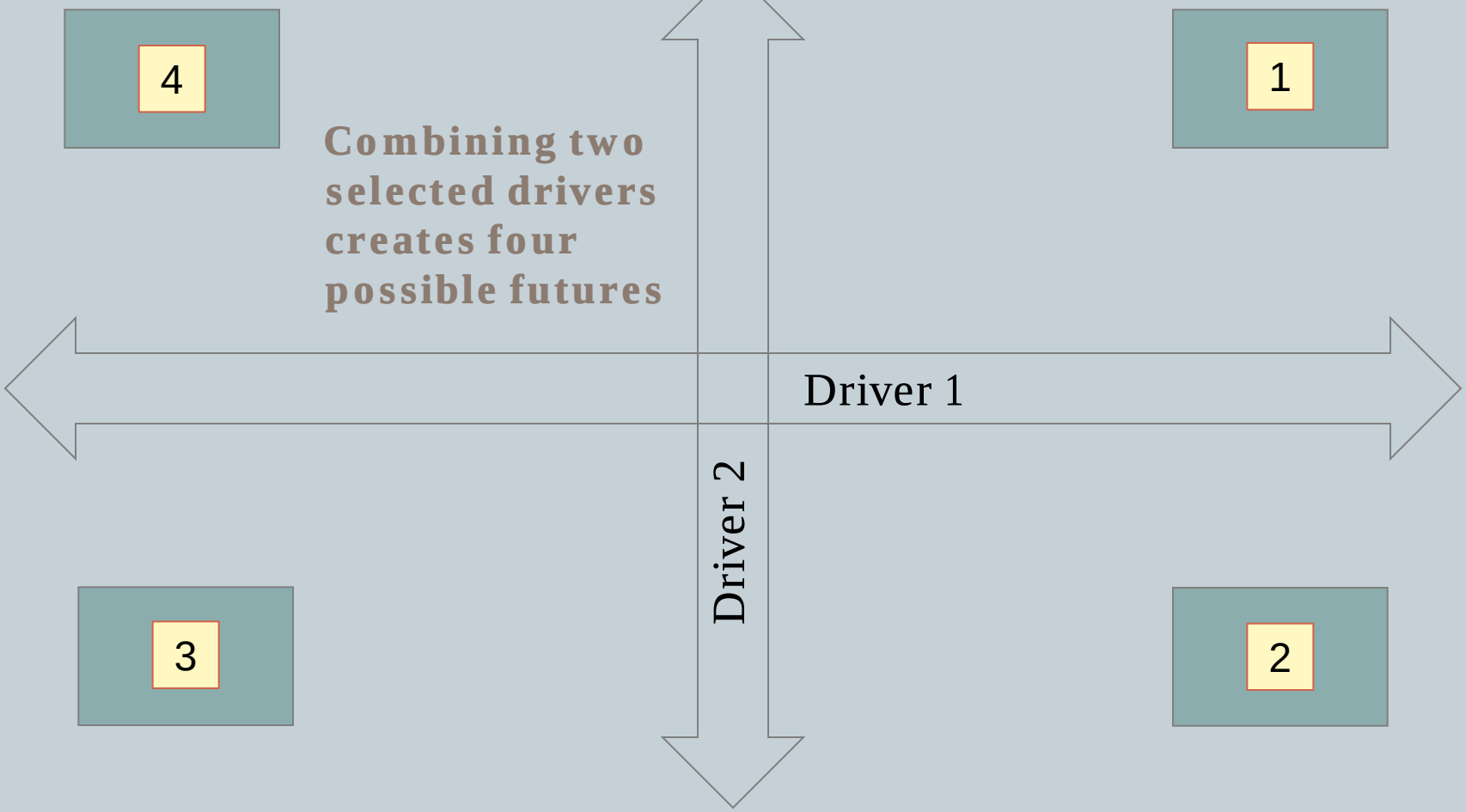
What **critical forces** will affect the future of our issue?




Critical forces generally have unusually **high impact** and unusually **high uncertainty**

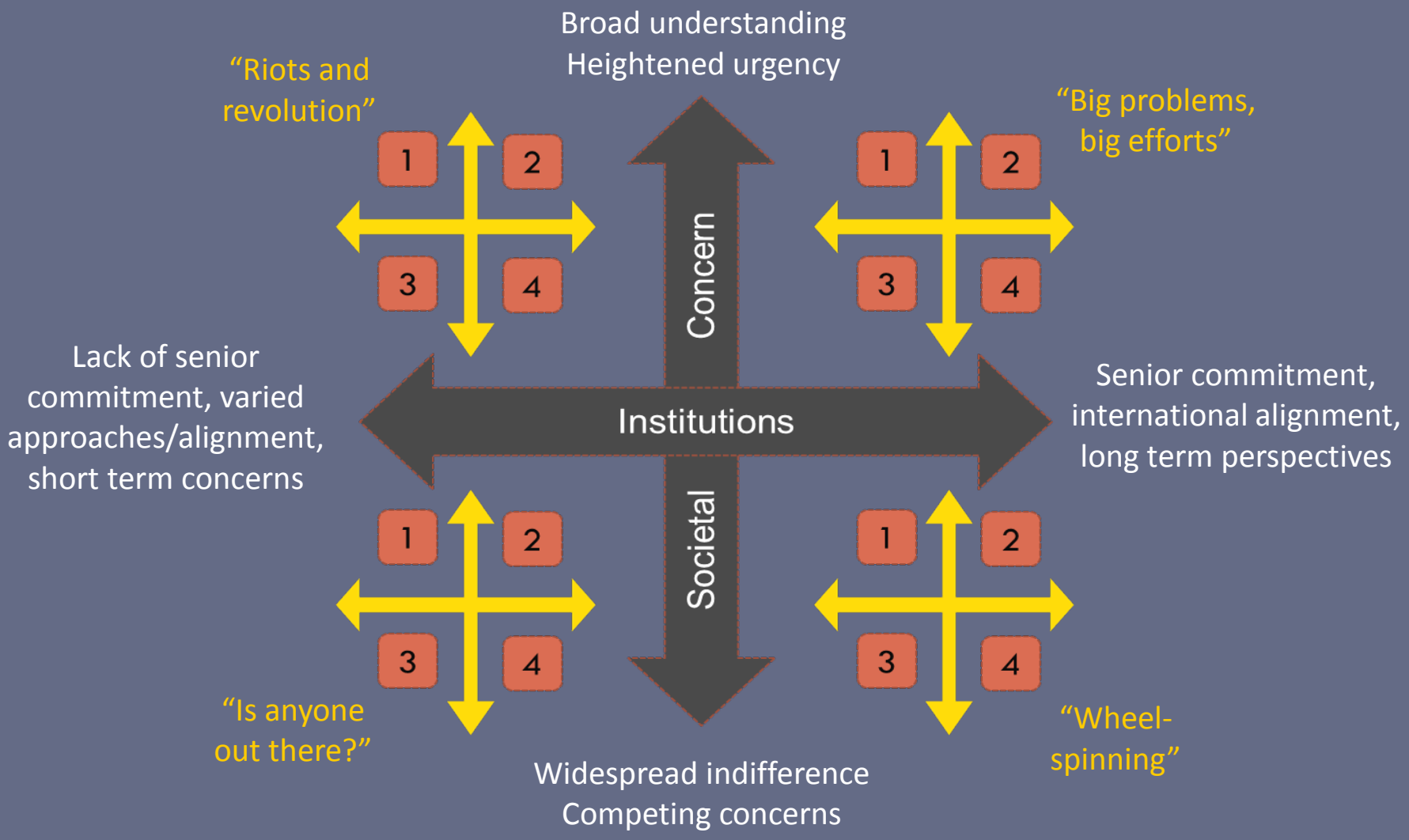
# CLIMATE SCENARIOS

BIOREGION: _____



# "Nested Scenarios"?

**Nesting each story in a social framework creates 16 possibilities:**



# NESTED SCENARIO DETAILS

BIOREGION:_____

**Socio-Political**

_____

**Bioregion Climate**

**Describe This World in 2030**

**Major Impacts on the Bioregion**

**Issues Facing Management**

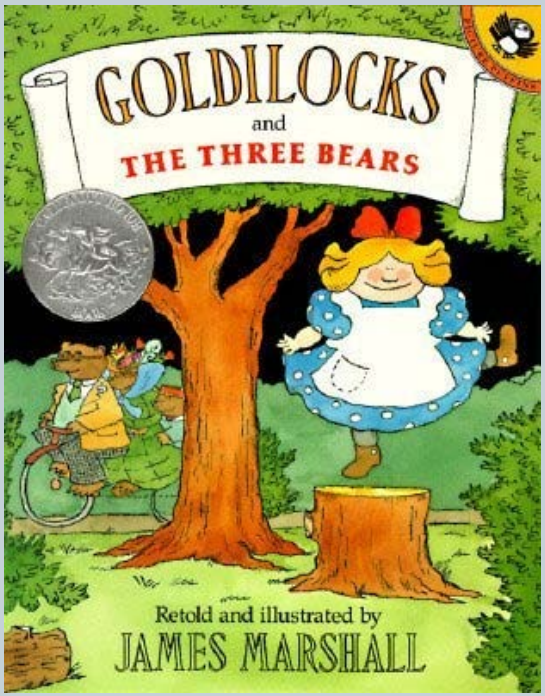
## Step 3: Synthesize

The 16 possible futures created in the preceding steps must be narrowed down to 3-4 scenarios that are relevant, divergent, challenging, and pertinent. Each has it's own narrative (story).

# Step Three: Synthesize

**How do we combine and synthesize these forces to create a small number of alternative stories?**

- Sixteen (or more) choices available (4x4)
- Need to select only 3-4 to turn into narratives and planning tools
- Focus on scenarios that are:
  - Relevant
  - Divergent
  - Plausible
  - Challenging
- Create a narrative (story) about each scenario

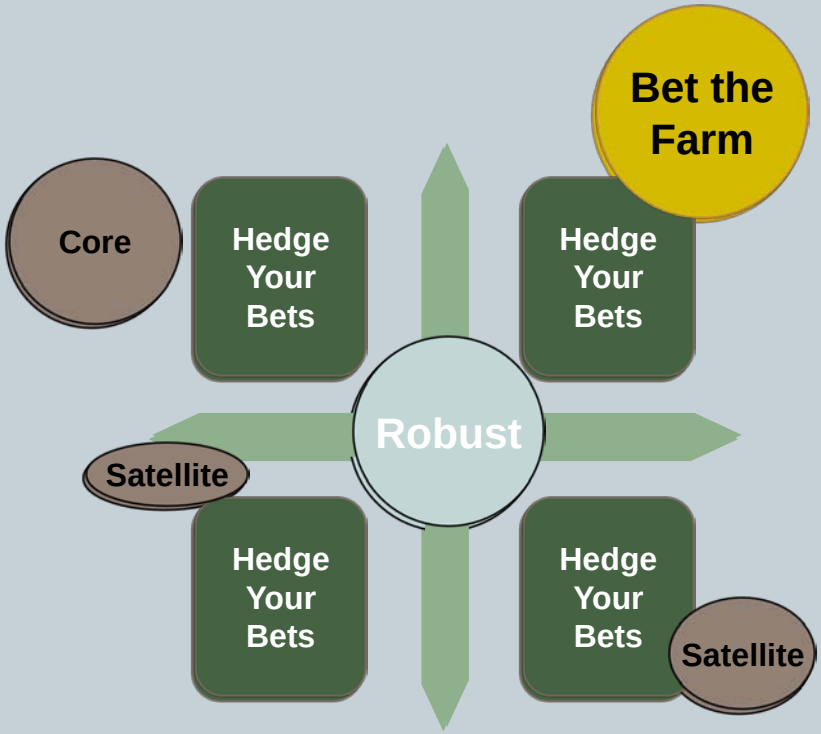


# Effective storytelling?

| Name | Species | Hair/Fur | Age | Appetite Level | Size | Preliminary Porridge Assessment | Preliminary Mattress Assessment |
|---|---|---|---|---|---|---|---|
| **Goldilocks** | Human | Blonde | 8 | Moderate | Petite | N/A | N/A |
| **Papa** | Bear | Brown | 12 | High | Big | Too Hot | Too Hard |
| **Mama** | Bear | Tawny | 11 | Moderate | Medium | Too Cold | Too Soft |
| **Baby** | Bear | Red-Brown | 3 | Low | Small | Just Right | Just Right |

# Step 4: Act

## Categorizing Options to Help Set Strategy




**Robust:** Pursue only those options that would work out well (or at least not hurt you too much) in any of the four scenarios

OR

**Bet the Farm / Shaping:** Make one clear bet that a certain future will happen — and then do everything you can to help make that scenario a reality

OR

**Hedge Your Bets / Wait and See:** Make several distinct bets of relatively equal size

OR

**Core / Satellite:** Place one major bet, with one or more small bets as a hedge against uncertainty, experiments, and real options

# Part IV:
# SWAN Workshop Results, Coastal

Selected drivers

Climate scenarios

Nested scenarios

Implications

Actions

Research

No regrets actions

# Selected Drivers (Coastal)

**Drivers as rated for certainty and importance by the Coastal group.**

| Climate Drivers (or, "Scenario Drivers based on Climate") | Uncertain | High certainty | Important |
|---|---|---|---|
| Temperature | X | | X |
| Precipitation | X | | X |
| Freeze-up | | X | |
| Length of growing season | | X | |
| Sea Level | X | | |
| Water availability | X | | |
| Relative Humidity | X | | |
| Wind Speed (separate from Aleutian Low) | X (duration) | X (increase) | |
| PDO | X | | |
| Extreme Events (temperature) | | X | |
| Extreme Events (precipitation) | X | X | |
| Extreme Events (storms) | | X | X |

Additional drivers introduced by the group:

- Ocean Acidification
- Salinity (onshore/near shore)
- Aleutian Low
- Extreme Event (wind)
- AK Coastal Current

Selected drivers to explore:

*Acidification:* slight increase (-.1 pH) → major increase (-.4 pH) *Votes: 10*

*Temperature*: +2 C by 2050/+3 C by 2100 → +4C by 2050/+6C by 2100. *Votes: 9*

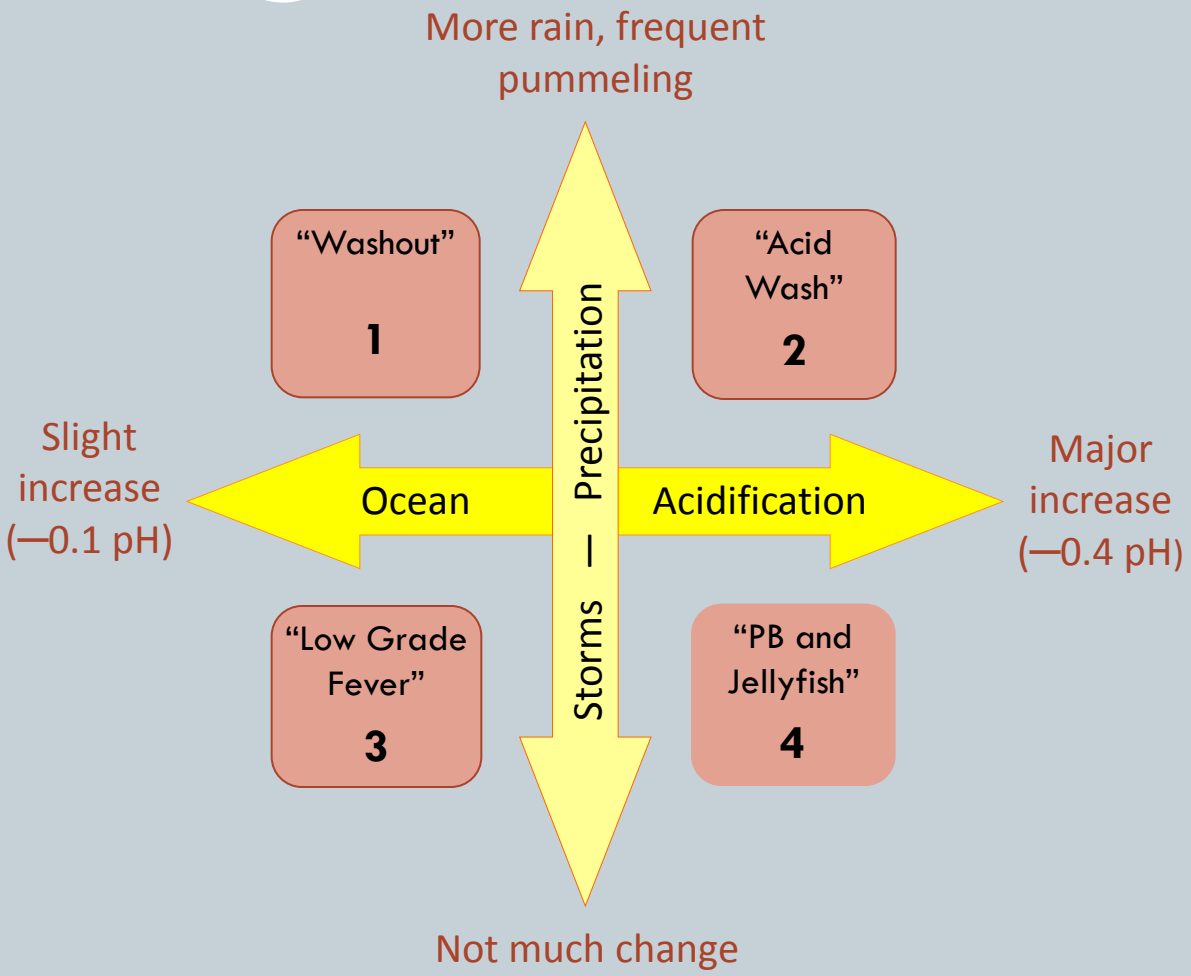
*Storms*: No/slight change → Frequent (biannual pummeling). *Votes: 6*

*Precip* (i.e., mean annual precip): same/some local decrease→ more rain, more total water. *Votes: 6*

# Climate Scenarios (Coastal)

**Matrix showing the intersection of changes in storms and precipitation and changes in ocean acidification, as each pertains to coastal regions.**

Each quadrant yields a set of future conditions which are plausible, challenging, relevant, and divergent.



# Climate scenarios 1&2 (coastal)

## "Washout"

- changes to habitat (influx of salt water)
- trail /road washout
- regular riparian disturbances
- more dynamic/changing coast leading to erosion
- larger floodplain and wetland
- less appealing destination
- destruction of cultural resources due to coastal erosion (communities/ facilities)
- possible need to relocate communities

## "Acid Wash"

- ecotourism crash
- removal of biota (fish, birds, sea mammals)
- spawning areas destroyed
- subsistence/recreation opportunities changed
- coastal erosion
- catastrophic collapse of salmon
  - collapse of fishing (subsistence, sport, commercial)
  - collapse of community cohesion/culture
- destruction of cultural resources/infrastructure
- loss of clam/mussel habitat and marine mammals that rely on them
- requests from communities to intro species for subsistence/sport
- change in species composition (more deer?)
- possible need to relocate communities.

# Climate scenarios 3&4 (coastal)

## "Low Grade Fever"

**(note: temperature change dominates)**

- increased drying of upland areas
- change in habitat (veg./animal composition)
- biomass may increase or decrease depending on location and veg.
- increased growing season
- less soil moisture
- increased glacial wasting?
- veg. expansion into deglaciated coastal areas
- redistribution of terrestrial mammals

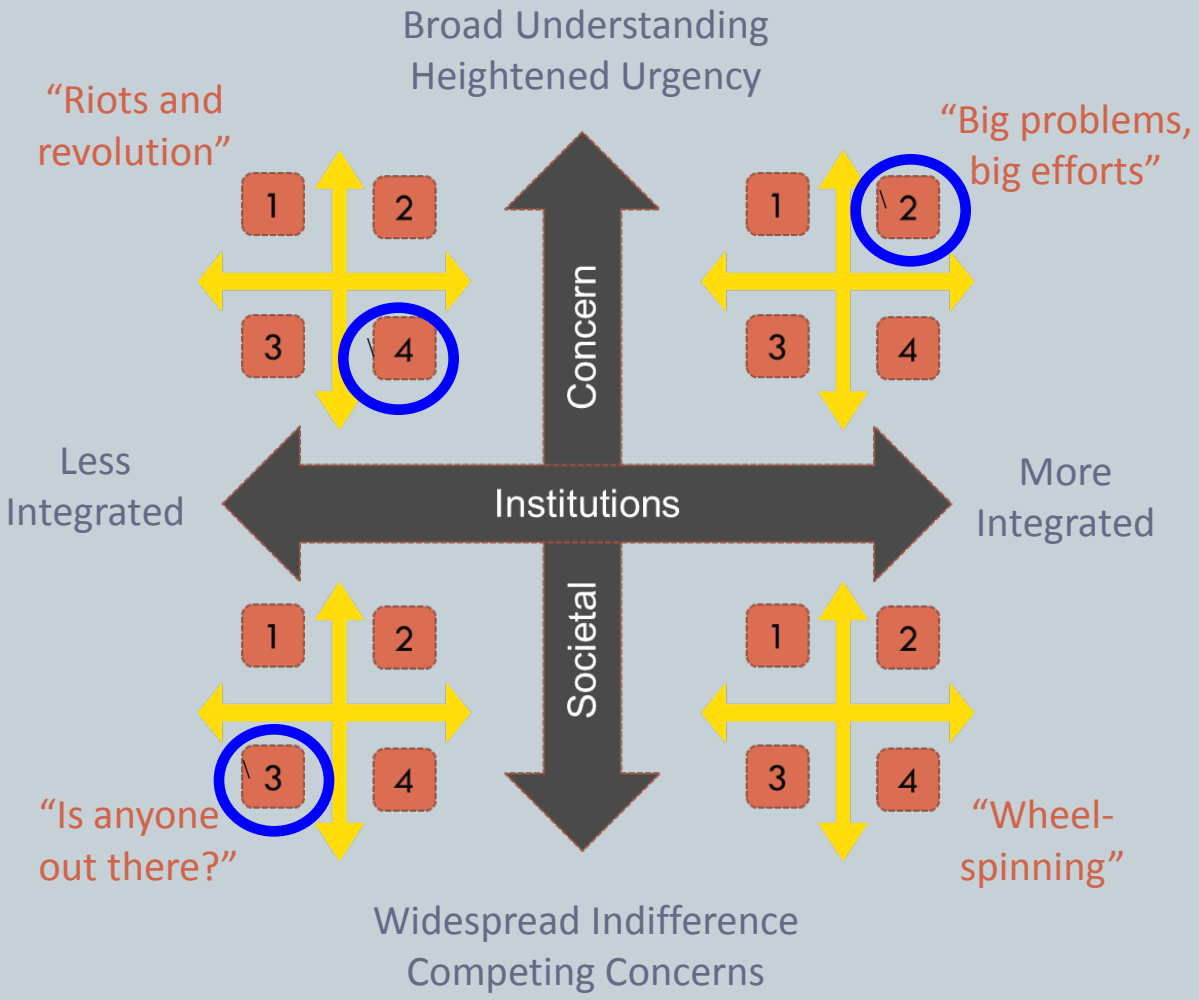
## "PB & Jelly Fish"

- loss of coastal species with exoskeleton →cascading effects for seabird populations and subsistence uses (both egg collecting and salmon)
- increase in jellyfish
- changes in fisheries (perhaps from salmon to tuna)
- type of change could shift appeal to visitors
- dramatic habitat change

# Nested Scenarios (coastal)

**Matrix showing coastal climate scenarios nested in a social/institutional framework.**

Each quadrant yields four linked scenarios; three are selected.



# Coastal Nested Scenario 1:

## PB&J/Riots and Revolution: "Jellyfish Jamboree, Fishing Fiasco"

## Implications

### Natural Resources

- Increased pest sand disease
- PSP (paralytic shellfish poisoning) increase
- Glacial retreat or disappearance
- Veg shifts with impacts to ungulates
- Major fisheries and ocean trophic restructuring
- Invasives – marine and terrestrial
- Species of concern: migratory birds and marine mammals

### Cultural Resources

- Archaeological site loss
- Cultural disconnect of sacred or significant sites

### Socioeconomic

- Oil and gas development, mining changes
- Alcoholism and disease in people with dietary and social changes
- Decline, conflicts in commercial and sport fisheries
- Village population declines w/ loss of subsistence and traditional economic base
- Reduced interest in marine wildlife viewing
- Impacts on transportation options due to loss of snow and ice

### Facilities

- Fire safe communities become a priority
- Changing priorities for funding as use changes and resource attractions shift

### Communication

- Communications budgets cut
- Managers unable to meet public demands for info (lack of funding, decentralized info)
- Visitor (external audience), e.g.:
  Poor access to glaciers
  Bear viewing moved or diminished

### Subsistence

- Loss/decline of traditional hunting species; some replacement species
- Increase in occurrence of PSP: human health impacts
- Collapse of salmon in maritime and riverine
- Plant/berry harvest changes
- Loss of language and traditions

# Coastal Nested Scenario 1:
## PB&J/Riots and Revolution: "Jellyfish Jamboree, Fishing Fiasco"
## Implications

- Natural Resources
  - Pest and disease: increased parasite loads → marine mammals, ungulates
  - Plant diseases: veg dieback
  - PSP (paralytic shellfish poisoning) increase
  - Glacial retreat or disappearance
  - Veg shifts with impacts to ungulates: increased black spruce, woody upright veg (alder/willow)
  - Major fisheries and ocean trophic restructuring
    - Failing: salmon, halibut
    - Gaining: unknown
  - Invasives
    - Marine: range extensions from BC/WA of tunicates and green crab
    - Terrestrial: new invasives, rapid proliferation in distribution and diversity. Range extensions.
  - Species of concern: migratory birds and marine mammals
- Cultural Resources
  - Archaeological site loss
  - Cultural disconnect of sacred or significant sites
- Socioeconomic
  - Oil and gas development: potential for mining, operational season changes
  - Alcoholism and disease in people with dietary and social changes
  - Decline and conflicts in commercial and sport fisheries/struggles with permitting and regulations for historic and or/emerging fisheries
  - Village population declines w/ loss of subsistence and traditional economic base
  - Reduced interest in marine wildlife viewing
  - Impacts on transportation options (overland, river boat, float plane access) due to loss of snow and ice
- Facilities
  - Fire safe communities become a priority
  - Changing priorities for facility funding as use patterns change and resource attractions shift location/
- Communication
  - Communications budgets cut; face-to-face interaction lessens
  - Public demands info; managers unable to meet demands (lack of funding, decentralized info)
  - Visitor (external audience)
    - Lack of changing venues to engage visitors
    - Fewer tour boat visitors
    - Poor access to glaciers
    - Bear viewing moved or diminished
- Subsistence
  - Loss/decline of traditional hunting species; some replacement species
  - Increase in occurrence of paralytic shellfish poisoning: health impacts to local population
  - Collapse of salmon in both maritime and riverine lifeways
  - Plant/berry harvest: change in timing (phenology) and species
  - Loss of language and traditions as local demographic changes (e.g. marine mammal customs and crafts)

# Coastal Nested Scenario 1 (cont'd):

## PB&J/Riots and Revolution: "Jellyfish Jamboree, Fishing Fiasco"

### Important Management Actions

- Energy development—renewable village development
- Economic development (local and community ventures and employment)
- Partnerships with NGOs and community groups (LCCs, RACs, development groups, local gov't, native orgs)
- Convert to local resource use
- Streamline public engagement by issues rather than by jurisdiction
- Implement facility standards for green energy use and efficiency
- Provide forums for sharing scientific efforts and expertise

### Research and Information Needs

- Develop relevant communication strategies to feed into existing networks; assign accountability
- Resource monitoring: shared responsibility, protocols between communities & agencies
  - Water quality
  - Fish and wildlife populations
  - Invasive species
- Trophic interaction linkages research
- Ocean acidification research
- Facilitation of academic research with clearly communicated needs
- Economic/energy development: emphasize mitigation options and build planning (NEPA) capacity

# Common No Regrets Actions: Coastal

1. Collaborate with researchers monitoring programs to track changes in PDO and ocean acidification
2. Model, collaborate and promote energy efficient technologies
3. Increase fluidity and connections between research and monitoring
4. Conduct coastal/marine ecosystem monitoring
5. Identify and cooperate with private/public entities for partnerships
6. Create portable, flexible structures
7. Re-imagine how institutions can work together to solve common problems.

# Part V: Conclusions

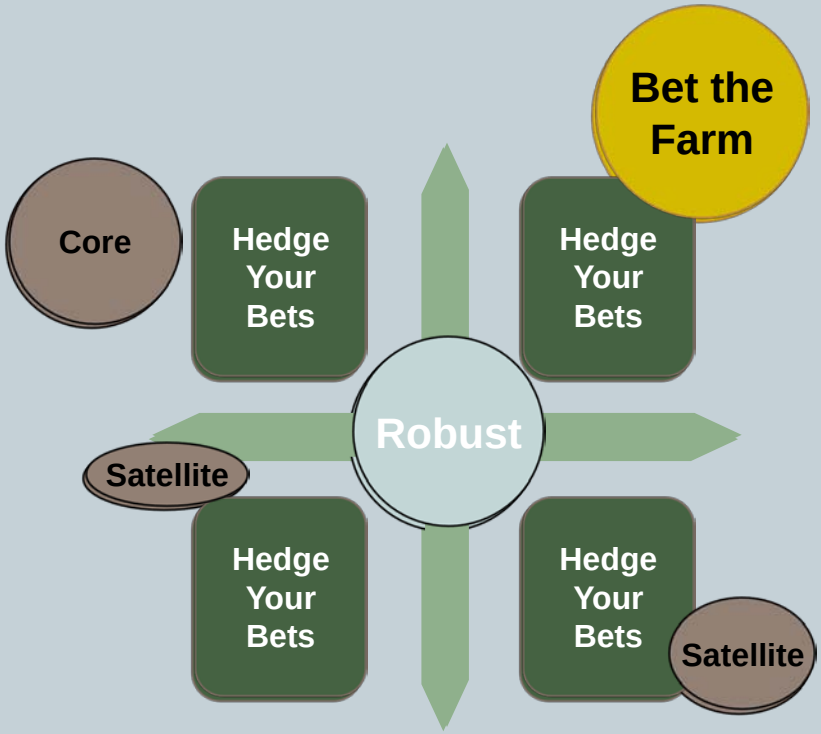
## CHOOSING RESPONSE STRATEGIES

## COMMON NO REGRETS ACTIONS

- data, research, and monitoring
- collaboration and outreach
- flexibility and innovation

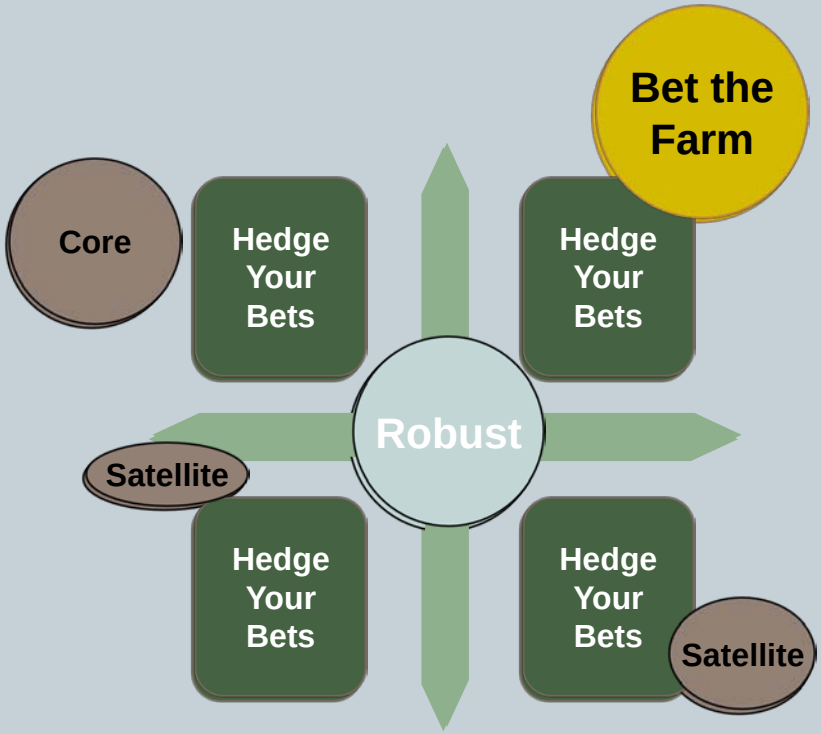
## NEXT STEPS

# Choosing Response Strategies




Robust responses are common no-regrets actions, but they are not the only possibility. In some cases, it may make sense to hedge bets to avoid an occurrence that appears in only one or two scenarios, or to set up core and satellite responses to deal with variability among scenarios.

# Step 4: Act
## Categorizing Options to Help Set Strategy




**Robust:** Pursue only those options that would work out well (or at least not hurt you too much) in any of the four scenarios

OR

**Bet the Farm / Shaping:** Make one clear bet that a certain future will happen — and then do everything you can to help make that scenario a reality

OR

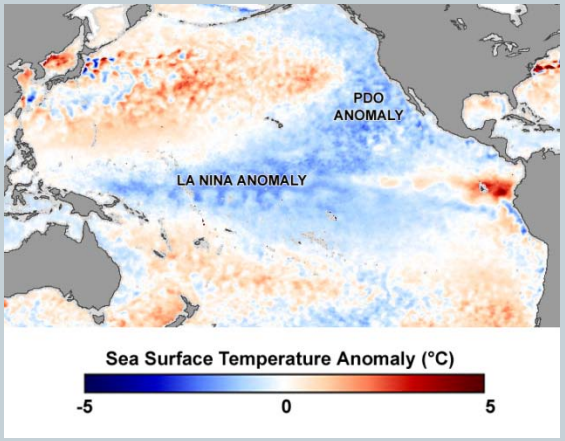
**Hedge Your Bets / Wait and See:** Make several distinct bets of relatively equal size

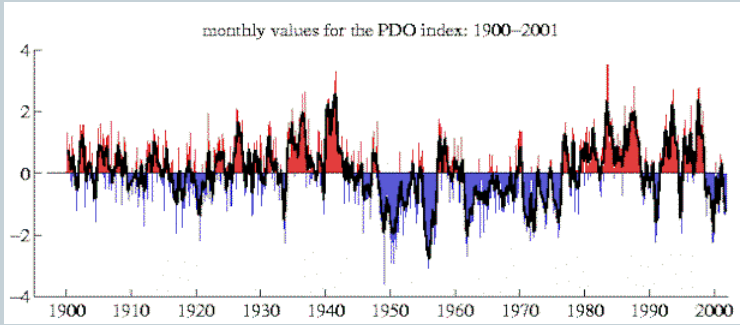
OR

**Core / Satellite:** Place one major bet, with one or more small bets as a hedge against uncertainty, experiments, and real options

# No regrets actions: data, research and monitoring

1. Create seamless data sets
2. Collaborate with researchers and monitoring programs to track changes in PDO and ocean acidification
3. Increase fluidity and connections between research and monitoring
4. Conduct coastal/marine/onshore ecosystem monitoring



# No regrets actions: collaboration and outreach

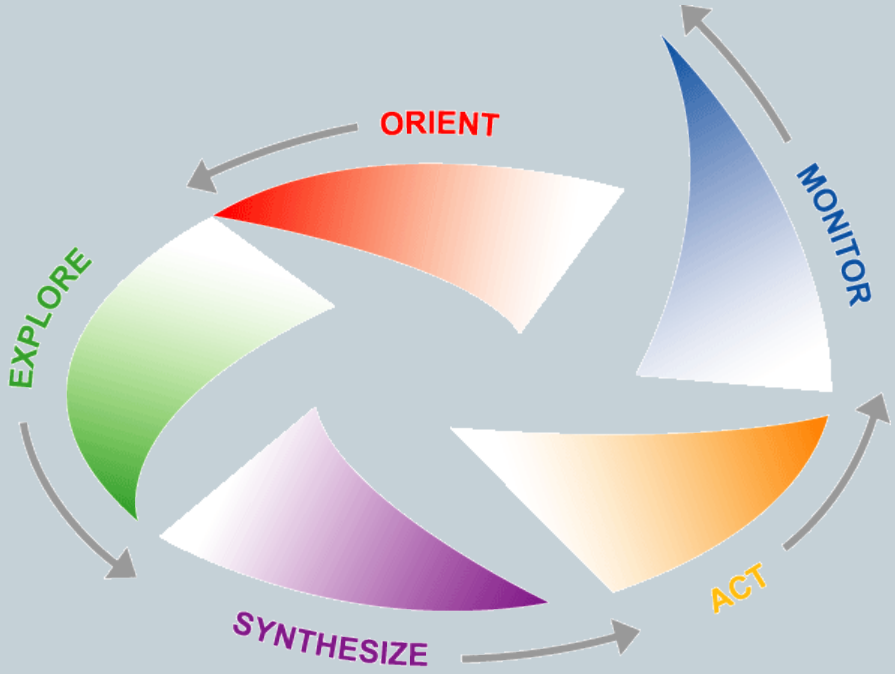
1. Coordinate communication with other agencies
2. Get missing players to the climate change scenario table at subsequent meetings
3. Provide science outreach and education to multiple audiences
4. Identify and cooperate with private/public entities for partnerships
5. Re-imagine how institutions can work together to solve common problems.

# No regrets actions: flexibility and innovation

1. Tune planning process to account for multiple possibilities
2. Model, collaborate and promote energy efficient technologies
3. Create portable, flexible structures

# Next Steps

***The scenario planning process does not end with "SYNTHESIZE"***




- Teleconferences and webinars to confirm results and fill in gaps
- Discussion of how to turn plans (no regrets management actions) into concrete actions
- Development of outreach tools and information, including final report
- Dissemination of scenarios and explanations of the process and results to a broad audience
- Feedback from a wider audience
- Linkages with planning for other park networks